
APPENDIX G-2

CONSTRUCTION EMISSION ESTIMATES

APPENDIX G2: CONSTRUCTION EMISSION ESTIMATES

This appendix provides summaries of construction emission estimates for projects proposed under the Proposed Action or the RLA Alternative. The appendix includes the fugitive dust and vehicle emission rate database used in the analysis plus summaries of annual construction emissions by installation. Summaries for the military vehicle trail construction projects include summaries of equipment use estimates by construction stage.

The detailed spreadsheets documenting the equipment emission rate database and the components of the emission calculations generally do not lend themselves to hard copy printing. Electronic versions of the spreadsheets can be made available on request.

DEFAULT CONSTRUCTION SITE FUGITIVE DUST EMISSION RATE ESTIMATES:

AP-42 5th Ed., Sect. 13.2.3 assumption:	1.2	TSP tons/acre-month, assuming 30 single-shift work days per month
	80.00	TSP pounds/acre/workday, single shift
CARB Area Source Methodology, Section 7.7 (adjusted for no control measures):		
Simple site grading, but no major cut-and-fill or excavation activity:	0.3432	TSP tons/acre-month, assuming 21 single-shift work days per month
	32.69	TSP pounds/acre/workday, single shift
	0.22	PM10 tons/acre-month, assuming 21 single-shift work days per month
	20.95	PM10 pounds/acre/workday, single shift
With major excavation & earthmoving:	1.3104	TSP tons/acre-month, assuming 21 single-shift work days per month
	124.80	TSP pounds/acre/workday, single shift
	0.84	PM10 tons/acre-month, assuming 21 single-shift work days per month
	80.00	PM10 pounds/acre/workday, single shift

Note: CARB estimates range from 40.9% to 156% of the generalized AP-42 daily TSP rate.

All data reflect typical loam type soil conditions. Loess deposits, peat soils, or poorly consolidated volcanic ash deposits can have significant wind erosion rates in addition to fugitive dust associated with direct disturbance by construction activity.

The data account for typical on-site construction activities, including site clearing, grading, foundation excavation, on-site vehicle traffic, etc.

If the project will require substantial off-site excavation of fill material from major borrow areas, emissions associated with borrow pit excavation, truck loading, and off-site unpaved haul road traffic may warrant additional separate analysis.

Small quantity off-site borrow pit activities and low volume haul road traffic may not warrant additional analysis, since the data are quite generalized to begin with.

The EPA estimate is based on TSP monitoring procedures at shopping center and apartment construction sites, and assumes 30 single-shift workdays per month.

CARB estimates are based on site activity data from construction projects in California and Nevada. Site activity was evaluated using EPA operation-specific emission factors to arrive at the overall PM10 emission rate estimates for construction activity.

CARB assumes that standard dust control practices provided 50% dust control at the monitored project sites. The data above have been adjusted to uncontrolled factors.

CARB assumes that PM10 accounts for about 64% of fugitive TSP ($PM_{10} \times 1.56 = TSP$). The CARB TSP estimates presented above are back-calculated values.

Given the procedures used to derive the CARB emission rate estimates, it should be valid to use the estimated TSP rates in combination with a project-specific PM10 fraction based on soil conditions.

NOTE: If using the CARB PM10 emission rate estimates directly, set the PM10 Portion of Fugitive Dust to 100%.

CARB also assumes 5 day/week construction activity (about 21 days/month) instead of the EPA assumption of 30 days/month.

The low range of CARB estimates is for typical residential, commercial, or office development with site grading but no major excavation or cut and fill earthmoving.

The high end of the CARB estimate is for major construction operations with substantial earthmoving activity.

Sources:

U.S. Environmental Protection Agency. 1995. Compilation of Air Pollutant Emission Factors (AP-42) 5th Edition, Volume I, Section 13.2.3.
 California Air Resources Board. 1997. Building Construction Fugitive Dust. Section 7.7 in Area Source Methodologies document (downloaded from CARB website; area source methodologies page: www.arb.ca.gov/emisinv/areasrc/areameth.htm;
 area source methodologies, Chapter 7 index page: www.arb.ca.gov/emisinv/areasrc/index7.htm).

DEFAULT PM10 FRACTION ESTIMATES FOR FUGITIVE DUST

SOIL TEXTURE CLASS	PERCENT CLAY	PERCENT SILT	PERCENT SAND	PERCENT CLAY + SILT	ESTIMATED % PM10
Silt and Clay Soils:					
Clay	40 - 100 %	0 - 60 %	0 - 45 %	55 - 100 %	45 - 85 %
Silt	0 - 10 %	80 - 100 %	0 - 20 %	80 - 100 %	40 - 80 %
Silty Clay	40 - 60 %	40 - 60 %	0 - 20 %	80 - 100 %	40 - 70 %
Silty Clay Loam	28.5 - 40 %	40 - 72.5 %	0 - 20 %	80 - 100 %	40 - 70 %
Loamy Soils:					
Silty Loam	0 - 28.5 %	50 - 87.5 %	0 - 50 %	50 - 100 %	30 - 70 %
Clay Loam	28.5 - 40 %	15 - 52.5 %	20 - 45 %	55 - 80 %	35 - 60 %
Loam	7.5 - 28.5 %	30 - 50 %	25 - 52.5 %	47.5 - 75 %	30 - 50 %
Sandy Clay	35 - 55 %	0 - 17.5 %	45 - 65 %	35 - 55 %	20 - 40 %
Sandy Soils:					
Sandy Clay Loam	20 - 35 %	0 - 27.5 %	45 - 80 %	20 - 55 %	15 - 40 %
Sandy Loam	0 - 20 %	0 - 50 %	42.5 - 85 %	15 - 57.5 %	10 - 35 %
Loamy Sand	0 - 15 %	0 - 30 %	70 - 90 %	10 - 30 %	5 - 25 %
Sand	0 - 10 %	0 - 15 %	85 - 100 %	0 - 15 %	0 - 10 %

Notes:

Soil texture classes and associated clay, silt, and sand fractions are based on the U.S. Department of Agriculture soil texture classification system.

Clay = soil particles with a sieve diameter below 2 microns (but may form much larger particle aggregates).

Silt = soil particles with a sieve diameter between 2 and 50 microns.

Fine silt: 2 - 10 microns; medium silt: 10 - 20 microns; coarse silt: 20 - 50 microns.

Sand = soil particles with a sieve diameter between 50 and 2,000 microns.

Very fine sand: 50 - 100 microns; fine sand: 100 - 250 microns; medium sand: 250 - 500 microns; coarse sand: 500 - 1000 microns; very coarse sand: 1000 - 2000 microns.

1 micron = 0.001 millimeters = 0.00003937 inches

PM10 = inhalable particulate matter (a size-dependent fractional sampling of particles smaller than 50 microns aerodynamic equivalent diameter). PM10 samplers collect essentially 100% of submicron particles, 50% of 10 micron aerodynamic diameter particles, and 0% of particles larger than 50 microns aerodynamic equivalent diameter.

A sieve diameter is the width of the minimum screen opening (usually square) through which a particle will pass. Because soil particles often have complex shapes, the sieve diameter normally will be larger than the minimum physical dimension and smaller than the maximum physical dimension of the particle.

An aerodynamic equivalent diameter is a mathematical abstraction, not a physical dimension. The aerodynamic equivalent diameter is the diameter of a sphere with unit density (1 gram per cubic centimeter) having the same gravitational settling velocity as the actual particle under consideration. Settling velocities are influenced by physical size and shape, as well as by particle density. In most cases, the aerodynamic equivalent diameter can be approximated by the equivalent spherical diameter (volume diameter) of the particle.

See the USDA National Soil Characterization Database (http://soils.usda.gov/soil_survey/nscd/main.htm) for more precise size fractions of dominant soil series types.

Data Sources:

Wild, Alan. 1993. Soils and the Environment: An Introduction. Cambridge University Press.

Warrick, A. W. 2000. Soil Physics. Pages A-1 through A-17 in Malcolm E. Sumner (ed.), Handbook of Soil Science. CRC Press.

DEFAULT DUST CONTROL PROGRAM EFFECTIVENESS VALUES:

50%	typical measures, arid areas
65%	aggressive measures, arid areas
70%	typical measures, areas with frequent rain
85%	typical measures, areas where natural soils seldom dry out

Note: disturbed areas and soil stockpiles can dry out more readily than natural soils.

Construction site water trucks typically have tank capacities of 500 - 1,200 gallons. A 600 gallon tank is a 2.5 ton load, and a 1,200 gallon tank is a 5 ton load. At 6 mph with a 10-foot spray width, a water truck can cover about 7.3 acres per hour. Tank size and spray intensity will determine acreage covered per tank load. A rate of 600 gallons applied to 5 acres (120 gallons per acre) would be an application depth of 0.11 mm (0.0044 inches); a rate of 300 gallons per acre would be an application depth of 0.28 mm (0.01 inches). Effective dust control in arid areas probably requires cumulative daily application of 600 + gallons per acre (generally in two or more sprinkling passes). It takes 1,070 gallons/acre to achieve a 1 millimeter water application rate.

Water application rate (per pass):	600	gallons/acre	0.133680556	cu ft per gallon
	0.5612	mm depth	43,560	sq ft per acre
	0.0221	inches depth	25.40	mm per inch

WATER TRUCK ACTIVITY CALCULATIONS:

Average Area to be Sprinkled on Any Day:	12.5	acres
Daily Number of Sprinkling Passes:	2	passes
Water Application Rate Per Pass:	600	gallons/acre
Average Truck Speed:	5	mph
Average Spray Width:	10	feet
Water Truck Tank Size:	600	gallons
Average Tank Filling Rate:	200	gallons per minute
Average Transit Time Each Way:	3	minutes each way to/from fill location
Average Connect Plus Disconnect Time:	2	minutes per tank fill
Time Required for Tank Refilling:	11	minutes (including travel to/from fill location)
Required Truck Loads Per Day:	25.0	loads
Truck Fills Per Day:	25.0	loads
Acres Sprayed per Tank Load:	1.00	acres per load
Acres Sprayed Per Hour of Driving Time:	6.06	acres per hour
Driving Time per Complete Pass for Site:	2.06	hours
Daily Total Water Truck Operating Time:	8.71	cumulative hours
Number of Water Trucks Used On Site:	6	trucks
Daily Operating Hours per Truck:	1.45	hours per truck
Average Active Hours Per Day Per Truck:	2	hours per day per truck
Average Operating Time Factor per Truck:	73%	hourly operating time factor

ANNUAL CONSTRUCTION EMISSIONS, SCHOFIELD BARRACKS CONSTRUCTION PROJECTS

PROJECT	YEAR	CONSTRUCTION ACTIVITY EMISSIONS, TONS PER YEAR				
		ROG	NOx	CO	SOx	PM10
RANGE CONTROL BUILDING	2004					
	2005					
	2006					
	2007	0.85	8.14	3.44	0.73	2.83
	2008	1.10	10.15	4.27	0.92	2.11
	2009	0.22	2.05	0.85	0.19	0.43
VIRTUAL FIGHTING FACILITY	2004					
	2005					
	2006					
	2007	0.91	8.50	3.51	0.77	2.87
	2008	0.66	6.04	2.47	0.55	1.11
	2009					
MOTOR POOL FACILITY	2004					
	2005	2.16	21.75	8.79	2.00	3.10
	2006	1.12	10.61	4.34	0.97	5.57
	2007	0.17	1.58	0.64	0.14	0.90
	2008					
	2009					
VEHICLE WASH FACILITY	2004					
	2005	0.83	8.21	3.58	0.74	8.05
	2006	0.15	1.45	0.58	0.13	1.60
	2007					
	2008					
	2009					
FIXED TACTICAL INTERNET	2004					
	2005	0.02	0.21	0.09	0.02	0.03
	2006					
	2007					
	2008					
	2009					
WAA APRON IMPROVEMENTS	2004					
	2005					
	2006	1.49	14.64	6.34	1.30	1.72
	2007	0.17	1.78	0.65	0.16	0.28
	2008					
	2009					
MULTIPLE DEPLOYMENT FACILITY	2004					
	2005					
	2006	2.38	22.80	9.83	2.06	5.36
	2007	0.18	1.62	0.72	0.15	1.46
	2008					
	2009					
TOTALS BY YEAR	2004	0.00	0.00	0.00	0.00	0.00
	2005	3.01	30.17	12.45	2.76	11.18
	2006	5.14	49.50	21.10	4.46	14.24
	2007	2.28	21.62	8.97	1.95	8.33
	2008	1.76	16.19	6.73	1.46	3.21
	2009	0.22	2.05	0.85	0.19	0.43
TOTAL EMISSIONS		12.42	119.52	50.11	10.82	37.39

Notes:

ROG = reactive organic compounds

NOx = oxides of nitrogen

CO = carbon monoxide

SOx = sulfur oxides

PM10 = inhalable particulate matter (below 50 microns aerodynamic equivalent diameter); the "10" in PM10 is a 50% mass collection efficiency size for sampling devices, not a size limit

Emission estimates include vehicle exhaust emissions and fugitive dust; normal dust control measures assumed.

Source: Tetra Tech analyses.

ANNUAL CONSTRUCTION EMISSIONS, SCHOFIELD BARRACKS RANGE PROJECTS

PROJECT	YEAR	CONSTRUCTION ACTIVITY EMISSIONS, TONS PER YEAR				
		ROG	NOx	CO	SOx	PM10
BATTLE AREA COMPLEX	2004	4.97	47.62	20.86	4.27	8.15
	2005	2.88	27.04	10.46	2.43	12.19
	2006	0.21	2.03	0.79	0.19	0.50
	2007	0.00	0.00	0.00	0.00	0.00
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
UATCF FACILITY	2004	2.49	22.93	9.60	2.04	2.88
	2005	0.97	9.48	3.68	0.88	1.19
	2006	0.00	0.00	0.00	0.00	0.00
	2007	0.00	0.00	0.00	0.00	0.00
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
QTR1 RANGE	2004	3.37	29.90	12.89	2.60	6.76
	2005	1.02	10.11	3.84	0.93	1.29
	2006	0.00	0.00	0.00	0.00	0.00
	2007	0.00	0.00	0.00	0.00	0.00
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
QTR2 RANGE	2004	0.00	0.00	0.00	0.00	0.00
	2005	2.67	23.81	9.93	2.09	4.22
	2006	0.20	2.04	0.77	0.19	0.27
	2007	0.00	0.00	0.00	0.00	0.00
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
ALTERNATIVE 1 TOTALS BY YEAR	2004	10.84	100.45	43.35	8.91	17.79
	2005	7.54	70.46	27.91	6.33	18.89
	2006	0.41	4.07	1.55	0.37	0.78
	2007	0.00	0.00	0.00	0.00	0.00
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
ALTERNATIVE 2 TOTALS BY YEAR	2004	10.84	100.45	43.35	8.91	17.79
	2005	4.87	46.64	17.98	4.24	14.67
	2006	0.21	2.03	0.79	0.19	0.50
	2007	0.00	0.00	0.00	0.00	0.00
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
TOTAL EMISSIONS FOR ALTERNATIVE 1		18.79	174.97	72.81	15.61	37.45
TOTAL EMISSIONS FOR ALTERNATIVE 2		15.91	149.12	62.11	13.34	32.97

Notes:

ROG = reactive organic compounds

NOx = oxides of nitrogen

CO = carbon monoxide

SOx = sulfur oxides

PM10 = inhalable particulate matter (below 50 microns aerodynamic equivalent diameter); the "10" in PM10 is a 50% mass collection efficiency size for sampling devices, not a size limit

ESTIMATED EMISSIONS FOR CONSTRUCTION OF DILLINGHAM TANK TRAIL

EQUIPMENT USE SUMMARY:

PROJECT STAGE	ACTIVITY DURATION, DAYS	ACREAGE SUBJECT TO DISTURBANCE	NUMBER OF EQUIPMENT ITEMS	CUMULATIVE HOURS OF EQUIP USE	OFF-SITE FILL HAULING	
					TRUCK LOADS TO/ FROM SITE	TYPICAL LOADS PER DAY
RIGHT-OF-WAY CLEARING	164	27.9	12	9,832	300	2
ROADBED GRADING	200	30.0	33	26,210	15,666	78
ROAD SURFACING	96	34.7	26	8,947	6,226	66
	0	0.0	0	0	0	0
TOTALS OR AVERAGES:	250	34.7	44	44,989	22,192	89

Linear work progressions with overlap among activity stages reduces the total construction period to about 250 workdays (March 2006 - March 2007).

TYPICAL CONSTRUCTION DAY EMISSIONS:

PROJECT STAGE	COMPONENT	DAILY EMISSIONS, POUNDS PER DAY				
		ROG	NOx	CO	SOx	PM10
RIGHT-OF-WAY CLEARING	Equipment	25.4	242.8	96.6	21.4	23.2
	Fugitive Dust	0.0	0.0	0.0	0.0	1.9
ROADBED GRADING	Equipment	29.2	311.3	115.6	28.8	29.7
	Fugitive Dust	0.0	0.0	0.0	0.0	3.3
ROAD SURFACING	Equipment	20.8	216.5	74.6	20.0	19.0
	Fugitive Dust	0.0	0.0	0.0	0.0	5.1
	Equipment	0.0	0.0	0.0	0.0	0.0
	Fugitive Dust	0.0	0.0	0.0	0.0	0.0

CUMULATIVE CONSTRUCTION EMISSIONS:

PROJECT STAGE	COMPONENT	CUMULATIVE EMISSIONS, TONS PER YEAR				
		ROG	NOx	CO	SOx	PM10
RIGHT-OF-WAY CLEARING	Equipment	2.08	19.91	7.92	1.76	1.90
	Fugitive Dust	0.00	0.00	0.00	0.00	0.15
ROADBED GRADING	Equipment	2.92	31.13	11.56	2.88	2.97
	Fugitive Dust	0.00	0.00	0.00	0.00	0.33
ROAD SURFACING	Equipment	1.00	10.39	3.58	0.96	0.91
	Fugitive Dust	0.00	0.00	0.00	0.00	0.25
	Equipment	0.00	0.00	0.00	0.00	0.00
	Fugitive Dust	0.00	0.00	0.00	0.00	0.00
TOTALS	Equipment	6.00	61.43	23.06	5.60	5.78
	Fugitive Dust	0.00	0.00	0.00	0.00	0.73
	TOTALS	6.00	61.43	23.06	5.60	6.51

ESTIMATED EMISSIONS FOR CONSTRUCTION OF HELEMANO TANK TRAIL

EQUIPMENT USE SUMMARY:

PROJECT STAGE	ACTIVITY DURATION, DAYS	ACREAGE SUBJECT TO DISTURBANCE	NUMBER OF EQUIPMENT ITEMS	CUMULATIVE HOURS OF EQUIP USE	OFF-SITE FILL HAULING	
					TRUCK LOADS TO/ FROM SITE	TYPICAL LOADS PER DAY
RIGHT-OF-WAY CLEARING	148	29.7	11	8,836	150	1
ROADBED GRADING	201	38.2	34	21,718	16,557	83
ROAD SURFACING	97	22.4	20	7,658	2,921	31
	0	0.0	0	0	0	0
TOTALS OR AVERAGES:	250	38.2	42	38,212	19,628	79

Linear work progressions with overlap among activity stages reduces the total construction period to about 250 workdays (March 2005 - March 2006).

TYPICAL CONSTRUCTION DAY EMISSIONS:

PROJECT STAGE	COMPONENT	DAILY EMISSIONS, POUNDS PER DAY				
		ROG	NOx	CO	SOx	PM10
RIGHT-OF-WAY CLEARING	Equipment	25.3	241.9	96.4	21.3	23.1
	Fugitive Dust	0.0	0.0	0.0	0.0	2.8
ROADBED GRADING	Equipment	25.1	265.4	102.1	24.5	25.8
	Fugitive Dust	0.0	0.0	0.0	0.0	5.3
ROAD SURFACING	Equipment	16.3	171.6	59.9	15.9	15.0
	Fugitive Dust	0.0	0.0	0.0	0.0	3.2
	Equipment	0.0	0.0	0.0	0.0	0.0
	Fugitive Dust	0.0	0.0	0.0	0.0	0.0

CUMULATIVE CONSTRUCTION EMISSIONS:

PROJECT STAGE	COMPONENT	CUMULATIVE EMISSIONS, TONS PER YEAR				
		ROG	NOx	CO	SOx	PM10
RIGHT-OF-WAY CLEARING	Equipment	1.87	17.90	7.13	1.58	1.71
	Fugitive Dust	0.00	0.00	0.00	0.00	0.21
ROADBED GRADING	Equipment	2.52	26.67	10.26	2.47	2.60
	Fugitive Dust	0.00	0.00	0.00	0.00	0.53
ROAD SURFACING	Equipment	0.79	8.32	2.91	0.77	0.73
	Fugitive Dust	0.00	0.00	0.00	0.00	0.16
	Equipment	0.00	0.00	0.00	0.00	0.00
	Fugitive Dust	0.00	0.00	0.00	0.00	0.00
TOTALS	Equipment	5.18	52.89	20.30	4.82	5.03
	Fugitive Dust	0.00	0.00	0.00	0.00	0.90
	TOTALS	5.18	52.89	20.30	4.82	5.93

ANNUAL CONSTRUCTION EMISSIONS, DILLINGHAM TRAINING AREA CONSTRUCTION PROJECTS

PROJECT	YEAR	CONSTRUCTION ACTIVITY EMISSIONS, TONS PER YEAR				
		ROG	NOx	CO	SOx	PM10
FIXED TACTICAL INTERNET	2004	0.000	0.000	0.000	0.000	0.000
	2005	0.008	0.069	0.029	0.006	0.011
	2006	0.000	0.000	0.000	0.000	0.000
	2007	0.000	0.000	0.000	0.000	0.000
	2008	0.000	0.000	0.000	0.000	0.000
	2009	0.000	0.000	0.000	0.000	0.000
TOTALS BY YEAR	2004	0.000	0.000	0.000	0.000	0.000
	2005	0.008	0.069	0.029	0.006	0.011
	2006	0.000	0.000	0.000	0.000	0.000
	2007	0.000	0.000	0.000	0.000	0.000
	2008	0.000	0.000	0.000	0.000	0.000
	2009	0.000	0.000	0.000	0.000	0.000

Notes:

ROG = reactive organic compounds

NOx = oxides of nitrogen

CO = carbon monoxide

SOx = sulfur oxides

PM10 = inhalable particulate matter (below 50 microns aerodynamic equivalent diameter); the "10" in PM10 is a 50% mass collection efficiency size for sampling devices, not a size limit

Source: Tetra Tech analyses.

ANNUAL CONSTRUCTION EMISSIONS, KAHUKU TRAINING AREA CONSTRUCTION PROJECTS

PROJECT	YEAR	CONSTRUCTION ACTIVITY EMISSIONS, TONS PER YEAR				
		ROG	NOx	CO	SOx	PM10
VEHICLE WASH FACILITY	2004	0.00	0.00	0.00	0.00	0.00
	2005	0.00	0.00	0.00	0.00	0.00
	2006	0.00	0.00	0.00	0.00	0.00
	2007	0.83	8.21	3.58	0.74	8.05
	2008	0.15	1.45	0.58	0.13	1.60
	2009	0.00	0.00	0.00	0.00	0.00
FIXED TACTICAL INTERNET	2004	0.000	0.000	0.000	0.000	0.000
	2005	0.005	0.046	0.019	0.004	0.007
	2006	0.000	0.000	0.000	0.000	0.000
	2007	0.000	0.000	0.000	0.000	0.000
	2008	0.000	0.000	0.000	0.000	0.000
	2009	0.000	0.000	0.000	0.000	0.000
TOTALS BY YEAR	2004	0.000	0.000	0.000	0.000	0.000
	2005	0.005	0.046	0.019	0.004	0.007
	2006	0.000	0.000	0.000	0.000	0.000
	2007	0.826	8.211	3.579	0.739	8.048
	2008	0.150	1.452	0.583	0.130	1.602
	2009	0.000	0.000	0.000	0.000	0.000

Notes:

ROG = reactive organic compounds

NOx = oxides of nitrogen

CO = carbon monoxide

SOx = sulfur oxides

PM10 = inhalable particulate matter (below 50 microns aerodynamic equivalent diameter); the "10" in PM10 is a 50% mass collection efficiency size for sampling devices, not a size limit

Source: Tetra Tech analyses.

ANNUAL CONSTRUCTION EMISSIONS, KAHUKU TRAINING AREA RANGE CONSTRUCTION PROJECTS

PROJECT	YEAR	CONSTRUCTION ACTIVITY EMISSIONS, TONS PER YEAR				
		ROG	NO _x	CO	SO _x	PM ₁₀
CACTF FACILITY	2004	0.00	0.00	0.00	0.00	0.00
	2005	2.31	21.50	9.06	1.93	3.31
	2006	1.25	11.71	5.13	1.07	2.91
	2007	0.25	2.33	1.05	0.21	0.75
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
TOTALS BY YEAR	2004	0.00	0.00	0.00	0.00	0.00
	2005	2.31	21.50	9.06	1.93	3.31
	2006	1.25	11.71	5.13	1.07	2.91
	2007	0.25	2.33	1.05	0.21	0.75
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00

Notes:

ROG = reactive organic compounds

NO_x = oxides of nitrogen

CO = carbon monoxide

SO_x = sulfur oxides

PM₁₀ = inhalable particulate matter (below 50 microns aerodynamic equivalent diameter); the "10" in PM₁₀ is a 50% mass collection efficiency size for sampling devices, not a size limit

ANNUAL CONSTRUCTION EMISSIONS, POHAKULOA TRAINING AREA CONSTRUCTION PROJECTS

PROJECT	YEAR	CONSTRUCTION ACTIVITY EMISSIONS, TONS PER YEAR				
		ROG	NOx	CO	SOx	PM10
RANGE MAINTENANCE BUILDING	2004	0.00	0.00	0.00	0.00	0.00
	2005	0.83	7.99	3.41	0.72	2.33
	2006	1.06	9.78	4.13	0.88	2.09
	2007	0.17	1.64	0.68	0.15	0.33
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
AMMUNITION STORAGE AREA	2004	0.00	0.00	0.00	0.00	0.00
	2005	0.00	0.00	0.00	0.00	0.00
	2006	0.89	8.45	3.74	0.77	2.62
	2007	0.16	1.49	0.61	0.13	0.55
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
PTA VEHICLE WASH FACILITY	2004	0.00	0.00	0.00	0.00	0.00
	2005	0.00	0.00	0.00	0.00	0.00
	2006	0.83	8.21	3.58	0.74	6.51
	2007	0.15	1.45	0.58	0.13	1.29
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
BRADSHAW AIRFIELD UPGRADE	2004	0.00	0.00	0.00	0.00	0.00
	2005	0.00	0.00	0.00	0.00	0.00
	2006	2.05	19.91	8.14	1.79	2.26
	2007	0.37	3.56	1.46	0.32	0.52
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
PTA I3A FACILITIES	2004	0.00	0.00	0.00	0.00	0.00
	2005	0.81	6.84	4.77	0.61	1.07
	2006	0.05	0.51	0.20	0.05	0.08
	2007	0.00	0.00	0.00	0.00	0.00
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
FIXED TACTICAL INTERNET	2004	0.00	0.00	0.00	0.00	0.00
	2005	0.03	0.24	0.10	0.02	0.03
	2006	0.00	0.00	0.00	0.00	0.00
	2007	0.00	0.00	0.00	0.00	0.00
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
TOTALS BY YEAR	2004	0.00	0.00	0.00	0.00	0.00
	2005	1.67	15.06	8.27	1.35	3.43
	2006	4.88	46.87	19.80	4.22	13.56
	2007	0.86	8.14	3.33	0.73	2.69
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00

Notes:

ROG = reactive organic compounds

NOx = oxides of nitrogen

CO = carbon monoxide

SOx = sulfur oxides

PM10 = inhalable particulate matter (below 50 microns aerodynamic equivalent diameter); the "10" in PM10 is a 50% mass collection efficiency size for sampling devices, not a size limit

Source: Tetra Tech analyses.

ANNUAL CONSTRUCTION EMISSIONS, POHAKULOA TRAINING AREA RANGE CONSTRUCTION PROJECTS

PROJECT	YEAR	CONSTRUCTION ACTIVITY EMISSIONS, TONS PER YEAR				
		ROG	NOx	CO	SOx	PM10
BATTLE AREA COMPLEX	2004	3.08	28.22	12.40	2.51	15.95
	2005	18.31	156.67	68.39	13.38	38.30
	2006	1.96	18.92	7.75	1.74	3.22
	2007	0.00	0.00	0.00	0.00	0.00
	2008					
	2009					
ANTI-ARMOR LIVE FIRE RANGE	2004	3.94	36.79	15.97	3.27	6.10
	2005	2.21	20.27	8.35	1.80	3.97
	2006	1.30	12.18	5.34	1.12	2.79
	2007	0.00	0.00	0.00	0.00	0.00
	2008					
	2009					
QTR2 RANGE	2004	0.00	0.00	0.00	0.00	0.00
	2005	2.30	20.91	8.59	1.85	3.52
	2006	0.21	2.09	0.86	0.19	0.27
	2007	0.00	0.00	0.00	0.00	0.00
	2008					
	2009					
ALTERNATIVE 1 TOTALS BY YEAR	2004	7.02	65.01	28.36	5.78	22.05
	2005	20.52	176.94	76.75	15.18	42.27
	2006	3.26	31.10	13.08	2.86	6.01
	2007	0.00	0.00	0.00	0.00	0.00
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00
ALTERNATIVE 2 TOTALS BY YEAR	2004	7.02	65.01	28.36	5.78	22.05
	2005	22.82	197.85	85.34	17.03	45.79
	2006	3.47	33.19	13.94	3.05	6.28
	2007	0.00	0.00	0.00	0.00	0.00
	2008	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00

Notes:

ROG = reactive organic compounds

NOx = oxides of nitrogen

CO = carbon monoxide

SOx = sulfur oxides

PM10 = inhalable particulate matter (below 50 microns aerodynamic equivalent diameter); the "10" in PM10 is a 50% mass collection efficiency size for sampling devices, not a size limit

ESTIMATED EMISSIONS FOR CONSTRUCTION OF POHAKULOA TANK TRAIL

EQUIPMENT USE SUMMARY:

PROJECT STAGE	ACTIVITY DURATION, DAYS	ACREAGE SUBJECT TO DISTURBANCE	NUMBER OF EQUIPMENT ITEMS	CUMULATIVE HOURS OF EQUIP USE	OFF-SITE FILL HAULING	
					TRUCK LOADS TO/ FROM SITE	TYPICAL LOADS PER DAY
RIGHT-OF-WAY CLEARING	200	126.0	15	12,480	850	4
ROADBED GRADING	200	163.6	45	39,850	12,426	62
ROAD SURFACING	167	83.3	51	33,792	20,149	122
	0	0.0	0	0	0	0
TOTALS OR AVERAGES:	250	163.6	82	86,122	33,425	134

Linear work progressions with overlap among activity stages reduces the total construction period to about 250 workdays (March 2006 - March 2007).

TYPICAL CONSTRUCTION DAY EMISSIONS:

PROJECT STAGE	COMPONENT	DAILY EMISSIONS, POUNDS PER DAY				
		ROG	NOx	CO	SOx	PM10
RIGHT-OF-WAY CLEARING	Equipment	25.9	248.8	98.4	22.0	23.7
	Fugitive Dust	0.0	0.0	0.0	0.0	20.6
ROADBED GRADING	Equipment	50.0	527.8	197.6	50.1	50.0
	Fugitive Dust	0.0	0.0	0.0	0.0	35.8
ROAD SURFACING	Equipment	46.2	486.6	169.4	45.0	42.6
	Fugitive Dust	0.0	0.0	0.0	0.0	14.0
	Equipment	0.0	0.0	0.0	0.0	0.0
	Fugitive Dust	0.0	0.0	0.0	0.0	0.0

CUMULATIVE CONSTRUCTION EMISSIONS:

PROJECT STAGE	COMPONENT	CUMULATIVE EMISSIONS, TONS PER YEAR				
		ROG	NOx	CO	SOx	PM10
RIGHT-OF-WAY CLEARING	Equipment	2.59	24.88	9.84	2.20	2.37
	Fugitive Dust	0.00	0.00	0.00	0.00	2.06
ROADBED GRADING	Equipment	5.00	52.78	19.76	5.01	5.00
	Fugitive Dust	0.00	0.00	0.00	0.00	3.58
ROAD SURFACING	Equipment	3.86	40.63	14.15	3.76	3.56
	Fugitive Dust	0.00	0.00	0.00	0.00	1.17
	Equipment	0.00	0.00	0.00	0.00	0.00
	Fugitive Dust	0.00	0.00	0.00	0.00	0.00
TOTALS	Equipment	11.45	118.29	43.74	10.96	10.92
	Fugitive Dust	0.00	0.00	0.00	0.00	6.81
	TOTALS	11.45	118.29	43.74	10.96	17.74